

Serial No.: 09/938,223
Attorney Docket No.: DP-305926
Amendment

stiff inner ring 10 for the piezoelectric elements 11 of Japan 16 to push radially against for such piezoelectric elements 11 to radially outwardly expand against the flake spline 20 and to radially inwardly contract from the flake spline 20 to cause the flake spline 20 to change between an unflexed circular shape and a flexed elliptical shape. It is noted that Applicant's piezoelectric embodiment gives more displacement to the flexible first annular member 42 for a given expansion/contraction of the piezoelectric members 48 than does Japan. Applicant's design also provides for easier assembly of the harmonic motor 10.

Claim 16 also requires all piezoelectric members, which at any time are disposed on the inner circumference of the flex-spline gear, to be spaced apart from each other. Circumferentially neighboring piezoelectric elements 11 of Japan are not spaced apart from each other. Applicants' design avoids the radially-sliding friction of the abutting piezoelectric elements of Japan which provides a faster response.

The examiner's rejection of claims 7, 9, 10, 12, 15 and 17 as being "obvious", under 35 U.S.C. 103, is respectfully traversed. The examiner rejects these claims as being unpatentable over Japan in view of Tojo, Humphreys or Richter. Claims 7, 9, 10 and 12 depend from claim 2, and Applicant's previous remarks concerning the patentability of claim 2 over Japan are herein incorporated by reference. Claim 15 now requires each of the magnets 36 which at any time is disposed on the inner circumference of the flex-spline gear be disposed at all times on the inner circumference of the flex-spline gear. Claim 17 now requires each of the piezoelectric members 50 which at any time is disposed on the inner circumference of the flex-spline gear be disposed at all times on the inner circumference of the flex-spline gear. As previously noted, the piezo elements in Japan do not at all times contact the insides of the flex spline. Substituting electro-magnetic or magneto-restrictive transducer elements for the piezoelectric elements of Japan would still result in electro-magnetic or magneto-restrictive transducer elements which do not at all times contact the insides of the flex spline.

Claim 15 also requires all magnets, which at any time are disposed on the inner circumference of the flex-spline gear, to be spaced apart from each other. Claim 17 also

Serial No.: 09/938,223
Attorney Docket No.: DP-305926
Amendment

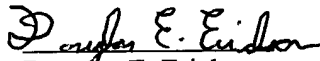
requires restrictive-restrictive members, which at any time are disposed on the inner circumference of the flex-spline gear, to be spaced apart from each other. Circumferentially neighboring piezoelectric elements 11 of Japan are not spaced apart from each other. Substituting electro-magnetic or magneto-restrictive transducer elements for the piezoelectric elements of Japan would still result in electro-magnetic or magneto-restrictive transducer elements which are not all spaced apart from each other.

It is clear that the patents cited by the Examiner, taken alone or in combination, do not teach, suggest, or describe the subject matter of Applicant's claimed invention.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned **"Version with markings to show changes made."**

Inasmuch as each of the rejections has been answered by the above remarks and amended claims, it is respectfully requested that the rejections be withdrawn, and that this application be passed to issue.

Respectfully submitted,


Douglas E. Erickson
Reg. No. 29,530

THOMPSON HINE LLP
2000 Courthouse Plaza NE
10 West Second Street
Dayton, Ohio 45402-1758
(937) 443-6814

Telephone: (248) 813-1235

Version with markings to show changes made

In the claims:

Claims 1-2 and 13-17 have been amended as follows:

1. (Twice Amended) A harmonic motor comprising:

a) a first annular member having a longitudinal axis, wherein the first annular member lies in a plane perpendicular to the longitudinal axis, and wherein the first annular member is flexible along a direction which lies in the plane;

b) a second member substantially coaxially aligned with the first annular member and lying in the plane, wherein one of the first annular and second members is rotatable about the longitudinal axis, and wherein the other of the first annular and second members is nonrotatable about the longitudinal axis; and

c) means for flexing the first annular member into at least two spaced-apart points of contact with the second member and for sequentially flexing the first annular member to rotate the at least two points of contact about the longitudinal axis which rotates the rotatable one of the first annular and second members about the longitudinal axis, wherein the flexing means is nonrotatable about the longitudinal axis [and is attached at least in part to the first annular member] and wherein each part of the flexing means which at any time contacts the first annular member is attached at all times to the first annular member.

2. (Twice Amended) A harmonic motor comprising:

a) a first annular member having a longitudinal axis, wherein the first annular member is nonrotatable about the longitudinal axis and lies in a plane perpendicular to the longitudinal axis, and wherein the first annular member is flexible along a direction which lies in the plane;

b) a second annular member substantially coaxially aligned with the first annular member and lying in the plane, wherein the second annular member is rotatable about the longitudinal axis; and

c) means for flexing the first annular member into at least two spaced-apart points of contact with the second annular member and for sequentially flexing the first annular member

to rotate the at least two points of contact about the longitudinal axis which rotates the second annular member about the longitudinal axis, wherein the flexing means is nonrotatable about the longitudinal axis [and is attached at least in part to the first annular member] and wherein each part of the flexing means which at any time contacts the first annular member is attached at all times to the first annular member.

13. (Twice Amended) A harmonic motor comprising:

- a) a harmonic-gear-train outer gear having a longitudinal axis;
- b) a harmonic-gear-train flex-spline gear having an inner circumference and disposed inside the outer gear, wherein one of the outer and flex-spline gears is rotatable about the longitudinal axis, and wherein the other of the outer and flex-spline gears is nonrotatable about the longitudinal axis; and
- c) means for flexing the flex-spline gear into two substantially diametrically opposite points of contact with the outer gear and for sequentially flexing the flex-spline gear to rotate the at least two points of contact about the longitudinal axis which rotates the rotatable one of the outer and flex-spline gears about the longitudinal axis, wherein the flexing means is nonrotatable about the longitudinal axis [and is attached at least in part to the flex-spline gear] and wherein each part of the flexing means which at any time contacts the flex-spline gear is attached at all times to the flex-spline gear.

14. (Twice Amended) A harmonic motor comprising:

- a) a harmonic-gear-train outer gear rotatable about a longitudinal axis;
- b) a harmonic-gear-train flex-spline gear having an inner circumference, disposed inside the outer gear, and nonrotatable about the longitudinal axis; and
- c) means for flexing the flex-spline gear into two substantially diametrically opposite points of contact with the outer gear and for sequentially flexing the flex-spline gear to rotate the at least two points of contact about the longitudinal axis which rotates the outer gear about the longitudinal axis in a direction opposite the direction of rotation of the at least two points of contact, wherein the flexing means is nonrotatable about the longitudinal axis [and is attached

Serial No.: 09/938,223
Attorney Docket No.: DP-305926
Amendment

at least in part to the flex-spline gear] and wherein each part of the flexing means which at any time contacts the flex-spline gear is attached at all times to the flex-spline gear.

15. (Amended) A harmonic motor comprising:

- a) a harmonic-gear-train outer gear rotatable about a longitudinal axis;
- b) a harmonic-gear-train flex-spline gear having an inner circumference, disposed inside the outer gear, and nonrotatable about the longitudinal axis;
- c) an array of spaced apart magnets disposed on the inner circumference of the flex-spline gear, wherein each of the magnets which at any time is disposed on the inner circumference of the flex-spline gear is disposed at all times on the inner circumference of the flex-spline gear, and wherein all magnets which at any time are disposed on the inner circumference of the flex-spline gear are spaced apart from each other; and
- d) a nonrotatable magnetic stator disposed inside and spaced apart from the array, wherein the magnetic stator is operable to magnetically repel and attract substantially diametrically opposite ones of the magnets of the array in a circumferentially sequential manner to create at least two substantially diametrically opposite rotating points of contact of the flex-spline gear with the outer gear to rotate the outer gear about the longitudinal axis.

16. (Amended) A harmonic motor comprising:

- a) a harmonic-gear-train outer gear rotatable about a longitudinal axis;
- b) a harmonic-gear-train flex-spline gear having an inner circumference, disposed inside the outer gear, and nonrotatable about the longitudinal axis; and
- c) an array of spaced apart, piezoelectric members disposed on the inner circumference of the flex-spline gear and operable to radially expand and contract substantially diametrically opposite portions of the flex-spline gear in a circumferentially sequential manner to create at least two substantially diametrically opposite rotating points of contact of the flex-spline gear with the outer gear to rotate the outer gear about the longitudinal axis, wherein each of the piezoelectric members which at any time is disposed on the inner circumference of the flex-spline gear is disposed at all times on the inner circumference of the flex-spline gear, and wherein all piezoelectric members which at any

Serial No.: 09/938,223
Attorney Docket No.: DP-305926
Amendment

time are disposed on the inner circumference of the flex-spline gear are spaced apart from each other.

17. (Amended) A harmonic motor comprising:

- a) a harmonic-gear-train outer gear rotatable about a longitudinal axis;
- b) a harmonic-gear-train flex-spline gear having an inner circumference, disposed inside the outer gear, and nonrotatable about the longitudinal axis; and
- c) an array of spaced apart, magneto-restrictive members disposed on the inner circumference of the flex-spline gear and operable to radially expand and contract substantially diametrically opposite portions of the flex-spline gear in a circumferentially sequential manner to create at least two substantially diametrically opposite rotating points of contact of the flex-spline gear with the outer gear to rotate the outer gear about the longitudinal axis, wherein each of the magneto-restrictive members which at any time is disposed on the inner circumference of the flex-spline gear is disposed at all times on the inner circumference of the flex-spline gear, and wherein restrictive-restrictive members which at any time are disposed on the inner circumference of the flex-spline gear are spaced apart from each other.

280423